DOCUMENT RESUME

ED 163 783 FL 009 876

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TITLE The Acquisition of Rules Governing "Possible Lexical Items:" Evidence From Spontaneous Speech Errors. Papers and Reports on Child Language Development, No. 13.
INSTITUTION Stanford Univ., Calif. Dept. of Linguistics.
PUB DATE Aug 77
NOTE 13p.

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Child Language; Cognitive Development; *Cognitive Processes; Comprehension Development; *Language Development; Language Research; *Linguistic Performance; Longitudinal Studies; Psycholinguistics; *Semantics; Sentence Structure; Surface Structure; *Syntax; Verbal Development; *Verbs

ABSTRACT

The acquisition of rules for formulating causative verbs was studied with children over a period of a few years. Most of the data is based on the spontaneous speech of the author's two daughters, from age 2;6 to 6;2 and from age 2;4 to 3;11. It was hypothesized that there are at least two prerequisites for the child's formulation of a general rule for converting noncausative predicates into simple causative sentences: (1) achievement of an underlying representation in which the semantic material conflated by the rule is spelled out relatively explicitly and (2) knowledge of some unanalyzed, memorized forms patterned according to the rule. It is concluded that in acquiring their lexicon children seem to be doing more than just working out the meanings of individual words. The child has rather abstract information about what lexical items are possible in her language, which allows her to predict, sometimes erroneously, that words with certain meanings will exist. The child's analysis of the semantic structure of her words seems to proceed in rather close conjunction with syntactic development. The close-to-simultaneous emergence of periphrastic (unconflated) causative sentences and their conflated counterparts at two stages of development in the study data suggests that sentences of both kinds are ultimately related to the same underlying structure. It is the achievement of this structure that allows the child to acquire a productive control over the variety of surface realizations of it that her language offers. (SW)

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PRCLD #13 (1977)

THE ACQUISITION OF RULES GOVERNING "POSSIBLE LEXICAL ITEMS:" EVIDENCE FROM SPONTANEOUS SPEECH ERRORS

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The fact that language is structured and rule governed on the levels of phonology, morphology, and syntax has long been recognized. Only recently, however, have linguists remarked on the possibility that the distribution of words across semantic space is also rule-governed -- that the way in which underlying semantic material combines or bundles into word-sized packages is subject to both universal and language-specific constraints (e.g., McCawley, 1970, 1971; Talmy, 1975, 1976). These constraints can be represented as rules of word formation that specify, in effect, what lexical items are possible in a language (McCawley, 1970).[1]

If there are rules governing the way semantic material combines into words, do language learning children acquire them? In principle, a child might get along quite well without such rules. He could simply memorize a number of individual words along with information about their referential properties and freely create novel sentences with them by applying his syntactic and morphological rules, never looking beneath the surface to discover the organizational principles along which his vocabulary is structured. However, there is some evidence that children do in fact analyze lexical structure in such a way as to extract some abstract principles of word formation. These principles allow them to predict that certain lexical items should exist whether or not they have ever heard such words.

In Bowerman (1974) I presented some data collected mostly from my older daughter, Christy, that I interpreted as providing evidence that children as young as two can learn a rule governing the formation of causative verbs from noncausative verbs, adjectives, and locative particles. Now Christy is three years older and my second daughter, Eva, has obligingly matured enough to produce some evidence of her own, so in this paper I will discuss a later stage in the development of sentences expressing causal relationships. At this later stage there is evidence, quite analogous to that from the earlier period, for children's learning a rule governing a type of causative verb, but this verb is somewhat more complex than the earlier one in that it packs in more semantic information.

The evidence for children's having learned rules governing both the earlier and later type of causative verb is in the form of systematic errors of overregularization, analogous to <u>foots</u>, <u>comed</u>, <u>breaked</u>, etc. Overregularization is possible in the domain of word formation as well as in morphology and syntax because rules for word formation, like morphological and syntactic rules, are subject to special constraints and

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irregularities. Overregularizations constitute important evidence for rule learning because, unlike correct forms, they cannot simply have been memorized as unanalyzed fragments. Rather, they must be produced on the basis of internalized structural principles (see Bowerman, 1974, for discussion). Most of the error data to be presented below was collected from Christy and Eva, but some supportive material gathered informally from several other children is also included.

In the interest of demonstrating how the earlier and later rules for formulating causative verbs are related, I will review the former, simpler case before getting into the latter, more complicated case.

Simple causative verbs. A basic premise agreed upon by many (by no means all) linguists is that at an underlying level causative sentences are composed of two complete propositions, linked through the abstract notion of CAUSE (or RESULT FROM) (e.g., Fillmore, 1971; Kastovsky, 1973; Talmy, 1975, 1976). The event spelled out in one of these propositions (the "causing event clause") specifies the cause of the occurrence of the event spelled out in the other proposition (the "resulting event clause"). This underlying structure can be realized in surface structure in many different ways, depending on factors such as how explicit the semantic material provided in the underlying structure is and whether the option is taken to compress certain semantic elements into single words or to leave them spread out as individual components.

The simplest situation is one in which the particular action that takes place in the causing event clause is left unspecified. This is illustrated schematically at the top of Table 1 (irrelevant problems like tense assignment are ignored). Here, John did something -- we don't know or don't say exactly what -- and as a result a door becomes open. There are two basic options for realizing this underlying structure in actual sentences; these are presented under A in Table 1. If we wish to leave the semantic material relatively spread out we produce a periphrastic causative sentence like John made the door open (or...(be)come open) or John got the door open (or, somewhat less probably, the door opened because of something John did, etc.).

Alternatively, in English but not in all languages, we can encode the same semantic material in a superficially simple sentence like John opened the door. In a sentence like this, the causative vert can be regarded as a single lexical item that incorporates not only the meaning of the original intransitive predicate (open, in this case, which in turn can be regarded as composed of an inchoative element BECOME plus open) but also the meanings represented by the abstract semantic elements ACT or DO (SOMETHING) and CAUSE.[2] The process of compressing two or more bits of semantic material into a single word has been termed conflation (Talmy, 1975).

Children's first rule for forming novel causative verbs is based on the pattern provided by English verbs like open and break. In other words, children simply take a noncausative predicate and use it without

modification as a causative verb. Much of the time this rule works well. However, there are exceptions and irregularities in English where the rule cannot be applied. For example, in some cases a noncausative predicate must undergo inflectional modification to become a causative verb. In other cases the causative form of a verb is morphologically unrelated to its noncausative counterpart. An in still other cases a noncausative predicate simply lacks a corresponding single-word causative form for either idiosyncratic or systematic reasons. When the child attempts to apply the zero-modification rule for deriving causative verbs to these "exceptional" predicates, overregularizations result; these allow us to infer that the child is in fact operating with such a rule. Some examples are presented as nos. 3-11 in Table 1. Further examples and discussion can be found in Bowerman (1974).

I have hypothesized (Bowerman, 1974) that there are at least two prerequisites for the child's formulation of a rule for deriving this type of causative verb. In the next section I will argue that exactly parallel prerequisites exist for the more complex type of causative verb. The first prerequisite is that the child must have achieved an underlying representation for causative sentences which spells out in relatively full form the semantic material that the rule for deriving a causative verb conflates or packages together into a single lexical item. In the several children from whom I have collected data, the evidence that this representation was achieved in the case of simple causative verbs is that the child began to produce surface structure versions of the unconflated semantic structure before or at the same time as conflated constructions with novel causative verbs appeared. For example, Christy began to produce periphrastic causative sentences with make and get (e.g., I make back wet) just one week before her first novel causative verb (Awant full Andrea bucket; = I want to make Andrea's bucket full). Possibly, however, some children produce novel causative verbs prior to periphrastic causative constructions -- if so, I would hypothesize that they should not do so before they could give evidence of understanding periphrastic causative constructions.

The second hypothesized prerequisite for the acquisition of a rule for deriving simple novel causative verbs is that the child must have in her lexicon some rote-learned examples of causative verbs that have a zero-modification relation with their noncausative counterparts -- e.g., open, break, and warm -- so that she has something to analogize from, some basis for inducing the new rule. In other words, she needs the raw material for implicitly forming analogies like the following: If another way to say Mary makes the door open is Mary opens the door, then another way to say He's gonna make you die must be He's gonna die you. This prerequisite was met in the case of Christy (see Bowerman, 1974), and it also held for Eva.

More complex causative verbs. The discussion above was limited to the case in which the causing event that brings about some event is left unspecified. But suppose we want to say not only that the door opened because of something John did but also that what John did was to pull

on the door. Or suppose we want to say that a ball went over a fence as a result of John's hitting it, or that John's tooth came out as a result of John's wiggling it. The hypothetical structure underlying sentences expressing states of affairs like these is presented at the top of Table 2. Examples 1) through 5) are all complex sentences, in that they either have coordinate or subordinate clauses or nominalizations. They all spell out relatively explicitly the underlying semantic information that there are two causally linked events. Sentences 6) through 8) differ in that superficially they are simple: John pulled the door open, John hit the ball over the fence, John wiggled his tooth out. In the terminology adopted in the present paper, two underlying clauses have been conflated into one surface clause. The main verbs of these conflated sentences -- pulled, hit, and wiggled -- are morphologically identical to the verbs in the underlying causing event clauses, but they are semantically more complex; that is, they incorporate additional semantic material. Thus, pull now means something like by pulling cause to become (or change state), hit means by hitting cause to move (or change location), and wiggle means by wiggling cause to move (or change location). This type of sentence is extremely common in English, but, like the simpler causative verb conflation we looked at earlier, it does not occur in all languages (cf. Fillmore, 1971; Talmy, 1976, for discussion).

Despite the productivity of this sentence pattern in English, there are certain restrictions on conflating a fully specified causing event clause and a resulting event clause (see McCawley, 1971; Fillmore, 1971; Green, 1972). Some are constraints on the types of verbs that are candidates for taking on the additional meaning "by verbing cause to move/become." For example, no verb prefixed with un- can be used in this way. Thus, while one can tie the string on, hook the train cars together, or fold the paper closed, one cannot *untie the string off, *unhook the train cars apart, or *unfold the paper open. Notice that this constraint, like those mentioned below, do not stem from semantic unlikeliness. The situations that would call for sentences like untie the string off arise just as often as those that call for sentences like tie the string on, but nevertheless we do not say such sentences. Rather, we must omit mention of the causing action by using a semantically relative "empty" verb like take: take the string off, or construct a syntactically more complex equivalent such as take the string off by untying it.

Other constraints block conflation not because of the nature of the verb itself but because the combination of certain verbs, which in some contexts permit conflation, with certain effects would result in ungrammatical sentences. For example, conflation cannot occur when negative causation is involved -- that is, when by performing some action the agent causes a certain event not to come about. For example, we can hold a child on the table (= by holding CAUSE child be on table) but we cannot *hold a child from falling off the table or *hold a child not falling off the table (=by holding CAUSE child NEG fall off table), or anything like this. Rather, a syntactically more complex construction with keep is required: keep (= CAUSE ... NEG) the child from falling off the table by holding her.

Similarly, conflation of two causally linked clauses is blocked when the predicate of the resulting event is a past participle (with the single exception of closed). Thus, I combed my hair smooth/free of tangles and I kicked the door open/ to smithereens are acceptable but not *I combed my hair untangled or *I kicked the door broken (but cf. I broke the door by kicking it, etc.).

Finally, other potential conflations of cause and effect are blocked on account of miscellaneous hard-to-specify constraints on combinations or because of "accidental gaps" in the lexicon where a verb for some non-obvious reason will not accept the operation. For example, compare the following pairs of ungrammatical and well-formed sentences: *He leaned the table into the corner (=by leaning on it caused the table to move into the corner) vs. He pushed the table into the corner (see Fillmore, 1971); *She wiped the table dirty/wet vs. she wiped the table clean/dry; *She shot him lame/blind vs. she shot him dead (see Green, 1972); *He ignored her sad vs. he made her sad by ignoring her.

What about children's grasp of the structure underlying constructions in which a fully specified causing event clause and a resulting event clause are conflated into a superficially simple causative sentence? Evidence that they indeed achieve an abstract rule governing sentences of this type is that at some point they begin to produce truly novel sentences cut to this pattern. This took place at age 3;6 for Christy and age 3;0 for Eva; all the examples I have gathered from other children were produced after age 3;6 (see examples 9-29 in Table 2). Mastery of this rule thus typically takes place perhaps a year or more after mastery of the rule for deriving the simpler type of causative verb discussed in the preceding section. This lag is not surprising given that more semantic material must be manipulated -- i.e., not only the result itself is specified but also the causing action.

Some of the novel sentences are acceptable, grammatical ones such as no. 9, Don't hug me off my chair (= don't by hugging me cause me to fall off my chair). Others are borderline acceptable (e.g., no. 11, He charmed him up in the basket...etc.). And still others are clearly ungrammatical, violating the constraints against performing the conflation when the causing action is a verb prefixed with un- (no. 12, untie it off), when negative causation is involved (nos. 13-15, e.g., I'll hit he from doing that (=I by hitting him will cause him not to do that), when the resulting event is lexicalized as a past participle (no. 16, I pulled it unstapled), or when various other "miscellaneous and hard to specify" conditions obtain (nos. 17-29, e.g., Feels like you're combing me baldheaded, I'm patting her wet, don't drive off my feet (= don't by driving (on my feet) cause my feet to come off).

In the last section I hypothesized that there are (at least) two prerequisites for the child's formulation of a general rule for converting noncausative predicates into simple causative sentences: 1) achievement of an underlying representation in which the semantic material conflated by the rule is spelled out relatively explicitly, and 2) knowledge of some hitherto unanalyzed, memorized forms patterned according

to the rule. The data from Christy and Eva suggest that these are also prerequisites for the child's formulation of a rule that allows her to use virtually any action verb freely and productively in such a way that it means by performing this action cause (something) to become (i.e., change state) or move (i.e., change location).

The achievement of a relatively complete underlying representation was signalled by the emergence, prior to the novel conflated constructions, of complex sentences in which the relationship between a causing event and a resulting event is made explicit (cf. nos. 1-5 under A in Table 2). For example, in Christy's development, the onset of novel conflated sentences like I'm pulling it unstapled took place about two months after sentences with because appeared (e.g., nos. 30, 31 in Table 2) and contemporaneously with those like no. 32 (The boy pushed the witch in the oven and that made her dead (= boy pushed witch....CAUSE she became dead)) and no. 35 (Anyway, you made me cry with (=by) putting those up there [= you put those up there CAUSE I cried]). This developmental timetable clearly suggests that these several sentence patterns, both the complex ones and the superficially simple ones like I pulled it unstapled, are not independent acquisitions; rather they are closely interrelated. All seem to reflect the child's achievement of a full representation in underlying structure of two causally-linked propositions, along with various rules for realizing this representation in surface sentences. The fact that the periphrastic, more explicit sentences tended to precede the conflated ones may well reflect one of the very general operating principles with which children approach language acquisition, according to Slobin (1973): "underlying semantic relations should be marked overtly and clearly."

What about the second hypothesized prerequisite, knowledge of some (modeled) exemplars of the pattern? In the case of the simple causative verb rule, such exemplars would be legitimate zero-modification causative verbs like open and break. Analogous blueprints for learning about the more complex type of causative sentence would be sentences like pull your socks up (= by pulling cause your socks to come up), spit/pour NP out (= by spitting...etc.), throw NP away/into NP, eat NP allgone, pound/push NP down/on , blow NP out, cut/tear NP off, etc. Such sentences were frequent in Christy's and Eva's speech from about the age of 2 on. However, the important thing to note here is that these particular combinations of causing-action plus resulting-event are all quite frequent in speech to children. This suggests they can probably be learned individually or as rules of rather limited scope for combining specific sets of action words with particular kinds of result complements. But what the child still lacks during this period when she produces sentences like I pour NP out and I pull NP up is the understanding that all these sentences are related -- that they all conform to a very abstract pattern which implies many other combinations that she has never heard. When she finally grasps this pattern, finally sees that all these types of sentences are "the same" in terms both of their syntactic structure and their abstract semantic configuration, then and only then does she begin to produce truly novel variants on the theme, both grammatical and ungrammatical (overregularized) ones.

Conclusion. By way of summary, two main points should be stressed. 1. In acquiring their lexicon children seem to be doing more than just working out the meanings of individual words. Rather, at some point they do some internal processing of at least certain subsets of these words, presumably involving an implicit comparison of some individual exemplars within the subsets, such that they arrive at an understanding of some rather general patterns governing how semantic material can be combined into lexical items. In other words, the child ends up with some rather abstract information about what lexical items are possible in her language, which allows her to predict (sometimes erroneously, due irregularities and other as-yet unlearned constraints) that words with certain meanings will exist. 2. The child's analysis of the semantic structure of her words appears not to take place in a vacuum, isolated from other domains of language acquisition. Rather, it seems to proceed in rather close conjunction with syntactic development. Thus, periphrastic construction patterns that spell out a given semantic content rather explicitly are acquired at about the same time or somewhat before productive construction patterns in which the same semantic material is compressed or conflated ("productive" must be stressed, since exemplars of the conflated forms will be present earlier in the child's speech but will not, according to the hypotheses put forth in this paper, be fully analyzed -- i.e., the abstract pattern by which they are structured will not yet be understood). The close-to-simultaneous emergence of periphrastic (unconflated) causative sentences and their conflated counterparts at two stages of development in the data from Christy and Eva suggests that sentences of both kinds are ultimately related to the same underlying structure, and that it is the achievement of this structure that allows the child to acquire a productive control over the variety of surface realizations of it that her language offers.

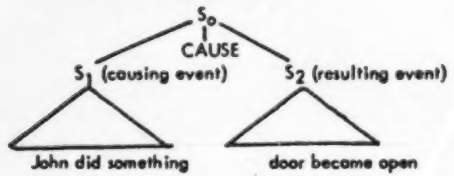
FOOTNOTES

[1]Rules of word formation that operate upon sublexical semantic material are to be distinguished from those that operate upon bound morphological entities such as -ity and -al. In this paper we will be concerned only with the former; see Halle, 1973, for a relevant discussion of the latter.

[2]How complex the underlying representation of the causing event should be when the causing action is lexically unspecified is controversial. (E.g., should it include ACT or DO (SOMETHING)? I have presented it here as fairly explicit because this representation allows the semantic relationships between causative sentences of various kinds to be clearly displayed and because both English-based (e.g., Fillmore, 1971) and cross-linguistic work (e.g., Kastovsky, 1973) indicates that such a representation captures important linguistic generalizations. However, it is not clear whether children's earliest novel causative verbs should be regarded as containing an element like ACT or DO (SOMETHING) in addition to CAUSE.

Table 1
Simple Causative Verbs

Causative sentences as consisting of two underlying propositions: Causing action not specified.



A. Some surface realizations of "John by doing something caused the door to become open":

1) John {made / got} the door open.

2) John opened the door.

Possible lexical item:

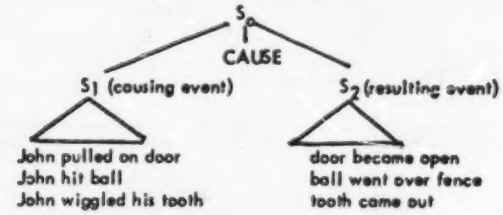
By doing something cause to become open → open.

Similar to "open" (zero modification):
By doing something cause to break/become broken → break
By doing something cause to become warm → warm

B. Child errors showing overgeneralization of "zero modification" rule for deriving a causative verb a) where inflectional modification is required (nos. 3-5 b) where a morphologically unrelated verb form is needed (nos. 6-9) and c) where there is an "accidental gap" in the English lexicon (nos. 10-11).

3) Christy, 2;11: I'm gonna sharp this pencil.(=sharpen)
4) Christy, 2;11: How would you flat it? (=flatten)
5) Eva, 2;4: Don't tight this 'cause I tight this.(=tighten)
6) Hilary, 4+: He's gonna die you, David. (=kill)
7) Christy, 2;9: I come it closer so it won't fall. (make come=bring)
8) Christy, 2;6: Mommy, can you stay this open? (make stay=keep)
9) Kendall, 2;3: Kendall fr'l that toy. (=drop)
10) Jennifer, 6+: Do you want to see us disappear our heads?
11) Christy, 3;6: Did she bleed it? (after sister hits head on table).

Table 2
Causative sentences with causing action specified



A. Possible surface realizations:

1) John {pulled on the door / hit the ball / wiggled his tooth} {and that / which} made it {(come) open / go over the fence / come out}
2) John {made the door (come) open / opened the door} by pulling on it.
3) John's pulling on the door made it (come) open.
4) The door opened from John's pulling on it.
5) The door opened {because / since} John pulled on it.
6) John pulled the door open
7) John hit the ball over the fence
8) John wiggled his tooth out

B. Children's sentences showing their grasp of rule for forming possible lexical item meaning "by performing action X cause to become/move."

1. Novel but acceptable or borderline acceptable sentences of this pattern (C=Christy, E=Eva, M=Mother).

9) Christy, 3;6: Don't hug me off my chair (as sister embraces her legs as she stands on stool.= by hugging cause me to fall off...)
10) Christy, 3;8: I'm pressing my crown out. (as flattens playdough "crown." = by pressing cause my crown to move out).
11) Christy, 4;1: (M and C watching cartoon snake charmer on TV; snake's basket is rising and falling):
M: Maybe the snake's going to charm the snake charmer.
C: No, he's not. He charmed him up in the basket. Then he charmed him down.

2. Violations of restrictions against conflation in the case of a) verbs prefixed by un-, (no. 12), b) negative causation (nos. 13-15), c) past participle in the effect proposition (no. 16), d) miscellaneous hard-to-specify constraints (nos. 17-29).

12) Christy, 3;10: Untie it off. (Wants M to untie piece of yarn and take it off trike handle).
13) Christy, 4;0: Will this squeeze the blood from going through? (Asking whether rubber band on her wrist would impede blood flow). (= by squeezing cause blood NOT to move)
14) Eva, 2;11: I'll hit he from doing that. (Then slaps a friend who took a toy away). (=by hitting cause him NOT to do that (move into doing that)).
15) Eva, 3;0: The birdies will find the squirrel and spank the squirrel from eating their birdseed...with their feet. (after squirrel got into birdfeeder).
16) Christy, 3;8: I pulled it unstapled. (After pulling a stapled book apart).
17) Mindy, 5;10: Feels like you're combing me baldheaded. (As M combs her hair)
18) Mindy, 5;6: Are you washing me blind? (as M wipes corners of her eyes).
19) Christy, 4;0: I'm patting her wet. (Patting sister's arm after dipping her hand into glass of water).
20) Christy, 3;6: And the monster would eat you in pieces. (telling a story).
21) Christy, 4;0: I opened it off of it. (After taking top off toy milk bottle).
22) Christy, 6;2: It's hard not to knock them down 'cause whenever I breathe I breathe them down (Having trouble setting up a paper village).
23) Andrea, 4;3: When you get to her, you catch her off. (she is on a park merry-go-round with doll next to her; wants a friend standing nearby to remove doll when doll comes around to her).
24) Eva, 3;11: (As M and E go towards Christmas tree with candy canes on it):
M: I'm going to eat a candy cane. Do you want one?
E: I'm going to choose it off.
25) Eva, 3;11: she choked me backward to the chair. (After C pulls on E with arm around her neck so both fall backwards into a chair).
26) Eva, 3;9: A gorilla captured my fingers. I'll capture his whole head off. His hands too. (as plays with rubber band around fingers).
27) Eva, 3;11: She jumped it off for Jennifer and Christy. (After someone had jumped up to pull an icycle down off eaves of house).
28) Christy, 4;6: Don't drive off my feet (=by driving (on them), make my feet come off. To friend who is nearby on a trike). Friend (misunderstanding): I'm not even going to drive on your feet.
29) Emily, 3;10: Then we'd shoot them back up. (After request for elaboration): ....shoot them to be alive. (Part of elaborate fantasy about killing people and then resurrecting them).

C. Illustrations from Christy's data of hypothesized relationship between the formulation of a rule governing "possible lexical items" meaning "by performing action X cause to become/move" and the achievement of an underlying representation in which the same semantic material is spelled out more explicitly.

Two months prior to new rule for possible lexical item, sentences like these:

30) 3;4: Now Eva don't get in my penny design because that will mess it up.
31) 3;4: Don't put my blanket on because that makes me too hot.

Contemporaneous with emergence of the rule, sentences like these:

32) 3;6: The boy pushed the witch in the oven and that made her dead.
33) 3;6: I probably got some snow on my hands and that made my whole body be cold.
34) 3;6: And he jumped on it and that made it break.

35) 3;6: Anyway, you made me cry with [=by] puting those up there.
36) 3;6: By jumping, it makes the beanbag all messed up.
37) 3;7: I can't go with [=by] turning my wheel because its broken.
38) 3;9: I wanted to surprise you with [=by] getting dressed.

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